

What is claimed is:

- 1 1. A method of detecting the presence of oil in turbine engine bleed air, comprising
2 the steps of:
3 sampling bleed air from the engine;
4 collecting the sampled bleed air;
5 sampling engine inlet air for the engine;
6 measuring the mass concentration and size distribution of aerosol particles in the
7 sampled engine inlet air with an aerosol sampler/size classifier;
8 measuring the mass concentration and size distribution of aerosol particles in the
9 collected sampled bleed air with the aerosol sampler/size classifier;
10 comparing the measured mass concentration and size distribution of aerosol particles in
11 the sampled engine inlet air with the measured mass concentration and size distribution
12 of aerosol particles in the collected sampled bleed air; and
13 determining that oil is present in the bleed air of the engine when the measured mass
14 concentration and size distribution of aerosol particles in the collected sampled bleed air
15 exceeds the measured mass concentration and size distribution of aerosol particles in
16 the sampled engine inlet air by a predetermined amount.
- 1 2. The method of Claim 1, wherein the step of sampling bleed air comprises sampling
2 bleed air from an engine bleed duct of the engine.
- 1 3. The method of Claim 1, wherein the step of collecting the sampled bleed air
2 comprises collecting the bleed air in a vented sample container.
- 1 4. The method of Claim 1, wherein the step of sampling engine inlet air comprises
2 sampling engine inlet air near an engine air inlet for the engine.

- 1 5. The method of Claim 1, wherein the steps of measuring the mass concentration
2 and size distribution of aerosol particles in the sampled engine inlet air and collected
3 sampled bleed air are made consecutively.
- 1 6. The method of Claim 5, wherein the step of measuring the mass concentration and
2 size distribution of aerosol particles in the collected sampled bleed air comprises
3 measuring a plurality of consecutive samples of collected bleed air for each
4 measurement of sampled engine inlet air.
- 1 7. The method of Claim 6, wherein the step of comparing comprises comparing the
2 measured mass concentration and size distribution of aerosol particles in each of the
3 plurality of consecutive samples of collected bleed air with the measured mass
4 concentration and size distribution of aerosol particles in the immediately preceding
5 sample of engine inlet air.
- 1 8. The method of Claim 1, wherein the step of determining that oil is present in the
2 bleed air of the engine when the measured particle count concentration of aerosol
3 particles in the collected sampled bleed air exceeds the particle count concentration of
4 aerosol particles in the sampled engine inlet air by a predetermined amount.
- 1 9. The method of Claim 1, wherein the step of determining that oil is present in the
2 bleed air of the engine comprises selecting a predetermined amount of mass
3 concentration of aerosol particles in the collected sampled bleed air that exceeds the
4 measured mass concentration of aerosol particles in the sampled engine inlet air by a
5 predetermined amount.
- 1 10. The method of Claim 9, wherein the step of determining that oil is present in the
2 bleed air of the engine comprises selecting a predetermined amount of mass
3 concentration of aerosol particles in the collected sampled bleed air that exceeds the
4 measured mass concentration of aerosol particles in the sampled engine inlet air by
5 approximately .02 mg/M³.
- 1 11. The method of Claim 1, wherein the engine is tested in a test cell.

1 12. The method of Claim 1, wherein the engine is tested on board an aircraft.

1 13. A method of detecting the presence of oil in turbine engine bleed air, comprising
2 the steps of:

3 sampling bleed air from an engine bleed duct of the engine;

4 collecting the sampled bleed air in a vented sample container;

5 sampling engine inlet air near an engine air inlet for the engine;

6 consecutively measuring the mass concentration and size distribution of aerosol
7 particles in the sampled engine inlet air and in the collected sampled bleed air with a
8 aerosol sampler/size classifier;

9 comparing the measured mass concentration and size distribution of aerosol particles in
10 the sampled engine inlet air with the measured mass concentration and size distribution
11 of aerosol particles in the collected sampled bleed air; and

12 determining that oil is present in the bleed air of the engine when the measured mass
13 concentration and size distribution of aerosol particles in the collected sampled bleed air
14 exceeds the measured mass concentration and size distribution of aerosol particles in
15 the sampled engine inlet air by a predetermined amount.

1 14. The method of Claim 13, wherein the step of consecutively measuring the mass
2 concentration and size distribution of aerosol particles in the sampled engine inlet air
3 and in the collected sampled bleed air comprises measuring a plurality of consecutive
4 samples of collected bleed air for each measurement of sampled engine inlet air.

1 15. The method of Claim 14, wherein the step of comparing comprises comparing the
2 measured mass concentration and size distribution of aerosol particles in each of the
3 plurality of consecutive samples of collected bleed air with the measured mass
4 concentration and size distribution of aerosol particles in the immediately preceding
5 sample of engine inlet air.

1 16. The method of Claim 13, wherein the step of determining that oil is present in the
2 bleed air of the engine when the measured particle count concentration of aerosol
3 particles in the collected sampled bleed air exceeds the particle count concentration of
4 aerosol particles in the sampled engine inlet air by a predetermined amount.

1 17. The method of Claim 13, wherein the step of determining that oil is present in the
2 bleed air of the engine comprises selecting a predetermined amount of mass
3 concentration of aerosol particles in the collected sampled bleed air that exceeds the
4 measured mass concentration of aerosol particles in the sampled engine inlet air by a
5 predetermined amount.

1 18. The method of Claim 17, wherein the step of determining that oil is present in the
2 bleed air of the engine comprises selecting a predetermined amount of mass
3 concentration of aerosol particles in the collected sampled bleed air that exceeds the
4 measured mass concentration of aerosol particles in the sampled engine inlet air by
5 approximately .02 mg/M³.

1 19. The method of Claim 13, wherein the engine is tested in a test cell.

1 20. The method of Claim 13, wherein the engine is tested on board an aircraft.

1 21. A method of detecting the presence of oil in turbine engine bleed air, comprising
2 the steps of:

3 sampling bleed air from an engine bleed duct of the engine;

4 collecting the sampled bleed air in a vented sample container;

5 sampling engine inlet air near an engine air inlet for the engine;

6 consecutively measuring the mass concentration and size distribution of aerosol
7 particles in the sampled engine inlet air and in the collected sampled bleed air with a
8 aerosol sampler/size classifier;

9 comparing the measured mass concentration and size distribution of aerosol particles in
10 the sampled engine inlet air with the measured mass concentration and size distribution
11 of aerosol particles in the collected sampled bleed air; and

12 determining that oil is present in the bleed air of the engine when the measured mass
13 concentration of aerosol particles in the collected sampled bleed air exceeds the
14 measured mass concentration of aerosol particles in the sampled engine inlet air by
15 approximately .02 mg/M³.

1 22. The method of Claim 21, wherein the step of consecutively measuring the mass
2 concentration and size distribution of aerosol particles in the sampled engine inlet air
3 and in the collected sampled bleed air comprises measuring a plurality of consecutive
4 samples of collected bleed air for each measurement of sampled engine inlet air.

1 23. The method of Claim 21, wherein the step of comparing comprises comparing the
2 measured mass concentration and size distribution of aerosol particles in each of the
3 plurality of consecutive samples of collected bleed air with the measured mass
4 concentration and size distribution of aerosol particles in the immediately preceding
5 sample of engine inlet air.

1 24. The method of Claim 21, wherein the engine is tested in a test cell.

1 25. The method of Claim 21, wherein the engine is tested on board an aircraft.